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INVESTIGATION TO RECOVER THE GOLD CONTAINED IN A SAMPLE SUBMITTED FROM FOREST HILL TAILING POND (N.S.)

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INVESTIGATION TO RECOVER THE GOLD CONTAINED IN A SAMPLE SUBMITTED FROM FOREST HILL TAILING POND (N.S.)

by

M.A. Cristovici*, G.W. Leigh**

ABSTRACT

An ore sample originating from the Forest Hill tailing pond in Nova Scotia and containing about 2 g/t Au was examined for gold extraction.

Three technological concepts were investigated: flotation, direct cyanidation and flotation followed by the cyanidation of the concentrate. The recommended process was cyanidation of the flotation concentrate (89% gold extraction), however the economics of the direct cyanidation (90-92% Au recovery) should be also evaluated. Flotation alone should not be considered since low-grade, non-saleable concentrate was produced.

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INTRODUCTION

In the last years following CANMET recommendations, a project was initiated to locate, in Canada, abandoned gold-silver tailing dumps of potential economic interest and to investigate the possibility of recovering the precious metals from these old deposits, by modern techniques.

Nova Scotia was one location in Canada where numerous gold processing plants were in operation in the early days. Before 1900 the milling practice consisted mainly of amalgamation and gravity concentration. Flotation and cyanidation were introduced at the turn of the century.

A literature search of Nova Scotia gold milling practice indicated that the metal recovery in the old flotation and cyanidation plants was very good, therefore the tailing ponds resulting from those operations would, very likely be of little or no economic importance. However, the gold recovery at the amalgamation and gravity concentration plants appeared to be lower, indicating the possibility that significant amounts of recoverable gold would have been carried with the tailings to the dump sites.

Following these findings particular attention was given to the old tailing ponds resulting from amalgomation or gravity concentration. Among the tailing dumps that belonged to this category was the area identified as Forest Hill, property of Seabright Resources Inc.

CANMET agreed to initiate a testwork program on gold tailings from Forest Hill property. This report covers the results of the investigation carried out at laboratory scale, on samples submitted by Seabright Resources Inc., from Forest Hill tailing pond.

OUTLINE OF THE INVESTIGATION

The testwork presented in this report is part of the investigation program intended to explore the possibilities of recovering the gold and silver values from old tailing ponds across Canada.

OBJECTIVES OF THE INVESTIGATION

A sample of gold tailing from Forest Hill property in Nova Scotia was received for testwork. The objectives of this investigation were as follows:

a) Determine the chemico-mineralogical characteristics of the tailing sample with respect to precious metals mineralization;

b) Investigate the possibility of recovering the precious metals from the tailing sample.

TESTWORK CONDITIONS AND RESULTS

Four samples, representing material from different depths of the Forest Hill tailing pond, were sent for testing.

A composite testwork sample was formed using equal amounts of the individual lots. This sample assayed:

2.3	g/t	Au
3.7	g/t	Ag
0.58	%	S

The mineralogical examination of the tailing samples, taken at various depth levels as well as the composite, indicated that most of the gold occurred as free grains of electrum (gold-silver alloy), with a minimum observed size of 4 μm.

The extraction of gold from the composite tailing sample was studied using the following methods:

A) Flotation,

B) Cyanidation of the entire ore,

C) Flotation followed by the cyanidation of the concentrate.

The optimum conditions and results of these investigations are presented in Table 1.

The response of the ore to these technological processes was quite good, the gold extraction being around, or over 90% in all cases. However the recommended method for treating this tailing was flotation followed by the cyanidation of the flotation concentrate.

The reasons for selecting this technology against flotation or cyanidation, as single processes, were:

- The flotation alone produced a concentrate too low in gold content (less than 25 g/t) to be accepted by smelters, which prefer to process high-grade gold cyanidation precipitates.

Table 1 - Summary of optimum conditions and results

Technology	Conditions				Results				
	Grind % -200 mesh	Reagents		pH	Products	% wt O/A	Assay Au g/t or mg/L	% Dist Au	
		Type	g/t, ore					Ind	O/A
Flotation	60.0	Aero 208 Xanth 301 MIBC	150 75 78	6.5	Head Conc Tails	100.0 9.1 90.9	2.0 20.2 0.17		100.0 92.2 7.8
Cyanidation 48 hours	60.0	NaCN CaO	300 5740	11	Head Cynd. sol'n Residue	100.0 - 100.0	1.99 0.56 0.19		100.0 90.5 9.5
Flotation and Concentrate Cyandiation 48 hours	60.0	Aero 208 Xath. 301 MIBC	150 75 78	6.5	Head Flot Conc Flot Tails	100.0 9.1 90.9	2.13 21.65 0.17	100.0 92.7 7.3	100.0 - 7.3
	98.5	NaCN CaO	91 1079	11	Flot Conc Cyan Sol'n Residue	9.1 - 9.1	21.65 2.92 0.86	100.0 96.0 4.0	92.7 89.0 3.7

- Cyanidation of the flotation concentrate (9% by weight) rather than that of the entire ore is likely to present a significant economic advantage, despite the extra cost of flotation and somewhat lower gold extraction.

The recommended flowsheet sketched in Fig. 1 consists of: grinding the tailing to approximately -65 mesh (60.0 % -200 mesh), bulk flotation, regrinding the flotation concentrate to 98.5% -200 mesh, thickening of the reground concentrate followed by 48 hours cyanidation, solid-liquid separation of the cyanide leach slurry and gold precipitation from the clarified solution. Adsorption of gold by carbon-in-pulp technique is an alternate route that could be considered for recovering the precious metal from cyanide leach slurry without the need for solid-liquid separation. However, at this time neither solid-liquid separation nor carbon-in-pulp adsorbtion has been studied for this ore.

CONCLUSIONS AND RECOMMENDATIONS

Based on the results of the testwork performed on Forest Hill tailing sample the following conclusions can be drawn:

A) The average content of the samples collected from this tailing pond was approximately 2 g/t Au. At this gold content the tailing pond could be of economic interest. However, the average gold assay of the entire deposit and the size of the orebody must be established before undertaking further work.

B) The testwork performed on a composite of the tailing samples has shown that approximately 90% of the gold contained in the ore could be recovered by flotation, cyanidation or combination of both. Although the cyanidation of the flotation concentrate was technologically considered the most suitable process for this material, economic evaluation of the direct cyanidation method should also be taken into account.

The positive results of this testwork warrant the continuation of the investigation aimed to recover the gold values from Forest Hill deposit.

The following recommendations are offered as regards the continuation of the test program:

a) A large, representative sample from the tailing pond should be obtained and submitted for assay and testwork.

b) Laboratory testwork should be carried out on this sample to optimize the conditions and results of the technologies examined in this study.

c) C.P.D.U. or pilot-plant experiments should follow using the same tailing sample, to verify the laboratory results on a larger scale and in continuous operation. Based on the pilot-plant work, one or two variants of flowsheet would be selected and finalized.

d) Using the metallurgical data and the information obtained as regards to size and grade of the tailing pond deposit a cost estimate should be prepared to evaluate the economics of the selected technologies.

DESCRIPTION OF THE TESTWORK

SAMPLES PREPARATION AND ASSAYS

Four samples weighing approximately 18 kg each, collected from Forest Hill tailing pond, were received for testwork. These samples were identified as 0-1 ft; 1-2 ft; 2-3 ft and 3-4 ft and they represented material taken between footage intervals, at various depths, from the pond.

Each footage interval sample was assayed and subjected to screen test. Then a testwork composite sample was formed by combining, in equal quantities, the individual samples.

The assays of the footage samples and of the composite are given in Table 2.

Table 2 - Head assay

Element	Sample				
	0-1 ft	1-2 ft	2-3 ft	3-4 ft	Composite 0-4 ft
Au, g/t	1.2	1.0	4.3	3.9	2.3
Ag, g/t	2.0	0.86	6.7	0.75	3.7
Pb %	0.05	0.01	0.01	0.01	0.01
Cu	0.01	0.01	0.01	0.01	0.01
Zn	0.02	0.01	0.01	0.01	0.01
Fe	2.71	2.47	3.28	3.25	2.93
Ni	0.01	0.01	0.01	0.01	0.01
Co	0.01	0.01	0.01	0.01	0.01
S	0.03	0.31	0.99	0.99	0.58
As	0.63	0.51	1.39	1.39	0.93
Ca	0.72	0.65	0.64	0.66	0.67
Mg	0.61	0.57	0.59	0.63	0.60
Tot. C	0.20	0.20	0.19	0.26	0.20

As can be seen from these assays the only element of interest in the tailing pond samples apprears to be the gold.

MINERALOGICAL EXAMINATION

The examination of the footage samples and the composite indicated that most of the gold occurred as free grains of electrum, some of which were coated in limonite and goethite mixtures. The minimum size of gold grains observed was 4 μm.

The complete description of the microscopic work is presented in the Mineralogical Report, Appendix A.

SIZE AND GOLD DISTRIBUTION IN THE TAILING SAMPLES

The size structure and the gold distribution in the tailing samples are given in Tables 3-7.

Table 3 - Size and Au distribution in sample 0-1 ft

Size		% Weight Retained	Assay Au, g/t	% Dist Au
Mesh	Microns			
+ 25	+ 710	0.4		
35	500	0.7		
45	355	5.9	1.3	19.6
60	250	15.1		
80	180	18.7	1.0	12.8
120	125	23.4		
170	90	14.6	0.7	18.2
230	63	9.8		
325	45	6.5	3.4	49.4
400	32	1.7		
		3.2		
	Total	100.0	1.5	100.0

Table 4 - Size and Au distribution in sample 1-2 ft

Size		% Weight Retained	Assay Au, g/t	% Dist Au
Mesh	Microns			
+ 25	+ 710	0.3		
35	500	0.5		
45	355	5.7	1.3	20.4
60	250	15.0		
80	180	19.7	0.84	12.0
120	125	23.2		
170	90	14.7	0.74	20.4
230	63	9.8		
325	45	6.4	3.1	47.2
400	32	1.7		
	- 32	3.0		
	Total	100.0	1.4	100.0

Table 5 - Size and Au distribution in sample 2-3 ft

Size		% Weight Retained	Assay Au, g/t	% Dist Au
Mesh	Microns			
+ 25	+ 710	0.4		
35	500	0.8		
45	355	5.8	1.4	12.2
60	250	14.3		
80	180	19.2	0.99	7.7
120	125	22.2		
170	90	14.3	0.79	11.7
230	63	9.9		
325	45	7.1	7.3	68.4
400	32	2.0		
	- 32	4.0		
	Total	100.0	2.5	100.0

Table 6 - Size and Au distribution in sample 3-4 ft

Size		% Weight Retained	Assay Au, g/t	% Dist Au
Mesh	Microns			
+ 25	+ 710	0.3		
35	500	0.7		
45	355	5.3	1.9	11.5
60	250	12.9		
80	180	15.4	1.3	6.3
120	125	20.5		
170	90	13.1	1.4	14.9
230	63	10.3		
325	45	8.9	6.7	67.3
400	32	3.4		
	- 32	9.2		
	Total	100.0	3.2	

Table 7 - Size and Au distribution in the composite sample

Size		% Weight Retained	Assay Au, g/t	% Dist Au
Mesh	Microns			
+ 25	+ 710	0.3		
35	500	0.7		
45	355	6.0	0.79	10.1
60	250	15.1		
80	180	18.6	0.87	9.4
120	125	22.2		
170	90	13.7	1.0	20.8
230	63	9.3		
325	45	6.8	4.4	59.7
400	32	2.2		
	- 32	5.1		
	Total	100.0	- 1.7	100.0

The screen tests indicated that 20-30% of the material in the tailing samples was passing through the 90 microns sieve. Also the gold assay of individual size fractions showed that more than 50% of the Au was concentrated in the fine fractions (-90 μm).

GRINDING TESTS

A series of tests were carried out to determine the conditions for grinding the composite testwork sample to -65; -100 and -200 mesh.

The grinding tests were performed under the following conditions:

a) Equipment: laboratory ball mill 20 cm diameter X 17 cm length. The grinding ball charge consisted of steel balls weighing 8623 g

b) Feed: 1000 g charge of tailing sample

c) Slurry density: 65% solids

d) Grinding time:

15 minutes for -65 mesh grind

23 minutes for -100 mesh grind

50 minutes for -200 mesh grind

The screen analyses of the tailing sample ground to -65, -100 and -200 mesh are given in Table 8.

Table 8 - Sieve analysis of the ground sample

Size		-65 mesh grind			-100 mesh grind			-200 mesh grind		
		% Retained		% Pass	% Retained		% Pass	% Retained		% Pass
Mesh (approx)	Microns	Ind	Cum	Cum	Ind	Cum	Cum	Ind	Cum	Cum
60	250	0.1	0.1	99.9	-	-	100.0	-	-	100.0
100	160	9.1	9.2	90.8	0.6	0.6	99.4	-	-	100.0
150	100	13.3	22.5	77.5	11.6	12.2	87.8	0.1	0.1	99.9
200	80	17.5	40.0	60.0	13.2	25.4	74.6	2.4	2.5	97.5
250	50	25.0	65.0	35.0	26.3	51.7	48.3	14.4	17.0	83.0
400	32	11.0	76.0	24.0	14.4	66.1	33.9	23.2	40.2	59.8
	-32	24.0	100.0	-	33.9	100.0	-	59.8	100.0	-
Total		100.0	-	-	100.0	-	-	100.0	-	-

FLOTATION TESTS

Flotation experiments were conducted to recover the gold minerals from the composite tailing sample.

The investigations aimed to determine the best reagent regime and the optimum grind.

The results of these investigations follow.

Determining the Best Reagent Regime

Several tests were carried out to establish the best combination of reagents for optimum gold recovery.

All these tests were performed under -100 mesh grinding conditions (74.6% -80 microns) and natural pH (6.5).

Combinations of various collectors were used and for each test bulk flotations were carried out after two consecutive additions of reagents. The two concentrates obtained were separately analysed or they were combined in a single product and assayed as such. A summary of the test results are given in Table 9.

Table 9 - Flotation results using various collectors

Test No.	Reagent		Flot. Concentrate		
	Collector	g/t	% Weight	Assay Au, g/t	% Dist., Au
1	Aerofloat 208	100	6.0	29.0	85.3
2	Aerofloat 208 Xanthate 301	150 75	7.3	27.1	90.3
3	Aerofloat 208 Xanthate 317	150 75	8.1	20.9	87.2
4	Aerofloat 242 Aero 404	150 75	21.9	9.5	93.0
5	Aerofloat 242 Xanthate 317	150 75	21.9	9.5	92.7
6	Aerofloat 208 Xanthate 301	150 75	7.6	26.1	92.3
7	Aerofloat 208 Xanthate 301	75 38	5.3	32.8	89.3
8	Aerofloat 208 Xanthate 301	50 25	5.8	27.8	88.6
9	Aero 3477 Xanthate 301	150 75	10.6	18.2	93.1
10	Aero 3477 Xanthate 317	150 75	10.6	17.1	92.7
11	Aero 3501 Xanthate 301	150 75	10.3	17.7	91.8
12	Aero 3501 Xanthate 317	150 75	8.6	20.0	91.3
13	Aero 404 Xanthate 301	150 75	4.2	38.4	88.9
14	Aero 404 Xanthate 317	150 75	4.2	39.8	87.9

These data indicated that the best results were obtained in test 2 or 6 (duplicate of test 2), using aerofloat 208 and aero 301 (sodium secondary butyl xanthate). Under these conditions concentrate of approximately 26 g/t Au were obtained for a gold recovery in excess of 90%.

Reducing the consumption of the optimum collectors was also tried in test 7 and 8. These tests showed that collector additions could be reduced to some extent, without significantly affecting the metallurgical results. It is believed that a reduction in amount of collectors added could most likely be obtained in continuous operation, where middling would be recirculated. However, for the rest of this testwork, since all the experiments were carried out in open circuit, the collector additions were maintained at the level used for test 2 or 6, to keep the gold recovery as high as possible.

Detailed conditions and results of the flotation tests carried out to determine the best reagent regime are presented in Appendix 2. (Tests 1-14)

Determining the Optimum Grind

Flotation tests, using reagents of test 2, were performed, under various grinding conditions to determine the optimum fineness for the flotation process.

Detailed conditions and results of these tests are given in Appendix 3 (Tests 20-23).

A summary of the flotation results obtained at various ore finenesses is presented in Table 10.

Table 10 - Flotation results at various ore finenesses

Test No.	Grind Mesh	Fineness % -80 µm (approx -200 mesh)	Flot Concentrate		Flot Tails Assay Au, g/t	% Recovery in Conc Au
			% Weight	Assay Au, g/t		
21	Nil	20.0	3.8	39.8	0.33	82.6
22	- 65	60.0	9.1	20.2	0.17	92.2
20	-100	74.6	8.6	24.3	0.20	92.0
23	-200	97.5	14.8	13.6	0.16	93.7

These data indicated that the optimum metallurgical results were achieved under -65 mesh grinding (approximately 60% -200 mesh).

Flotation of the tailing sample in the as-received state, without any grinding, resulted in a lower gold extraction, while a finer grind brought little or no increase in the gold recovery.

Optimum Conditions and Results (Flotation)

Based on the results of all flotation tests the following optimum conditions were established:

Grinding: -65 mesh (approx. 60% -200 mesh)

Reagents:

Aerofloat 208:	150 g/t
Xanthate 301:	75 g/t
MIBC:	78 g/t
pH:	natural, 6.5
Flotation time, minutes	9

Under the optimum conditions the following metallurgical results were obtained (Table 11).

Table 11 - Optimum flotation results

Product	% Weight	Assay Au, g/t	% Distribution Au
Head	100.0	2.0	100.0
Flot Conc	9.1	20.2	92.2
Flot Tails	90.9	0.17	7.8

CYANIDATION TESTS

Cyanidation tests were conducted, using the open bottle procedure, to evaluate the possibility of extracting the gold from the tailing composite sample, by cyanide leaching.

Two parameters were investigated: the cyanidation time and the ore fineness. All the tests were run using 1 g/ℓ NaCN concentration and pH>11.0. The oxigen content of the solution was not controlled at this time.

Determining the Optimum Cyanidation Time

A series of cyanidation tests were carried out with contact time varying between 12 and 48 hours. Some of the tests were run in duplicate

to confirm the results. All these cyanidation experiments were performed under -100 mesh grinding conditions.

Detailed conditions and results of these tests are presented in Appendix 4.

A summary of the results showing the influence of the cyanidation time is given in Table 12.

Table 12 - Cyanidation results at various contact time

Test No.	Contact Time (hours)	Assay, Au, g/t		% Au Rec in Cyanide Sol'n	Reagent Consumption kg/t	
		Head (calc)	Residue (assay)		NaCN	CaO
102A	12	2.10	0.39	81.5	0.5	4.84
102B	12	2.30	0.41	82.2	0.4	4.84
103A	24	2.06	0.24	88.3	0.4	6.12
103B	24	2.36	0.57	75.9	0.4	6.16
114	48	2.04	0.19	90.7	1.0	4.72
120A	48	2.17	0.16	92.7	0.6	5.46
120B	48	2.11	0.15	92.9	0.6	5.42

The results of these tests indicated that the best gold recovery, (over 90%) was achieved after the 48 hours cyanidation time. The cyanide consumption under these conditions was 0.6 kg/t.

Determining the Optimum Ore Fineness

Several tests were carried out to determine the optimum fineness for the cyanidation of the tailing sample. The tests were performed with ore in the as-received state as well as ground to -65, -100 and -200 mesh.

The influence of ore fineness was studied for 24 and 48 hours cyanidation time.

Detailed conditions and results of these tests are given in Appendix 4.

A summary of the results at various ore finenesses is presented in Table 13.

Table 13 - Cyanidation results at various ore finenesses

Test No.	Cyanide Time (hours)	Grind Mesh	Fineness % -200 Mesh	Assay, Au, g/t		% Au Rec in Cyanide Sol'n	Reagents Consumption kg/t	
				Head (calc)	Residue (assay)		NaCN	CaO
115	24	Nil	20.0	1.97	0.41	79.2	0.1	3.84
116	24	- 65	60.0	1.82	0.24	86.8	0.2	4.16
103A	24	-100	74.6	2.06	0.24	88.3	0.4	6.12
122A	24	-200	97.5	2.03	0.38	81.3	0.6	5.72
118A,B	48	Nil	20.0	2.26	0.22	90.3	0.6	5.58
119B	48	- 65	60.0	1.99	0.19	90.5	0.3	5.74
120A,B	48	-100	74.6	2.11	0.17	92.1	0.7	5.20
121A,B	48	-200	97.5	1.91	0.17	91.4	0.2	5.12

The data of these tests clearly indicated that the 48 hour cyanidation gave better gold extraction than 24 hours contact time, regardless of the ore fineness. This confirmed the findings of the previous series of tests carried out to establish the best cyanidation time. Considering the 48 hours cyanidation tests only, it appeared that the optimum results were obtained under -65 mesh grinding conditions, when the gold recovery reached 90.5%. Without any grind the gold extraction was about the same (90.3%) and under -100 and -200 mesh grinding a slight increase in the gold recovery was obtained. Although the difference in the gold recovery, between cyanidation of the tailing sample in the "as-received" state and ground to -65 mesh or finer was insignificant, it was considered that a slight grinding before cyanidation will be appropriate to destroy the agglomerations and to grind possible relatively large particles present in the tailing pond material, as well as to polish the surface of the mineral particles for better contact with the cyanide solution.

Optimum Conditions and Results

Based on the results of the cyanidation tests the following optimum conditions were established:

Grinding: -65 mesh (approx. 60% -200 mesh)

Cyanidation:

Slurry density:	33% solids
Protective alkali:	lime, pH>11.0
Solution concentration:	1 g/L NaCN
Contact time:	48 hours

The results obtained under these conditions are given in Table 14.

Table 14 - Optimum cyanidation results

Product	Assay, Au,		% Dist. Au	Reagents Consumption kg/t	
	mg/L	g/t		NaCN	CaO
Cyanide Sol'n	1.14		70.8		
Wash Sol'n	0.20		19.7	0.3	5.74
Residue		0.19	9.5		
Head (calc)		1.99	100.0		

FLOTATION FOLLOWED BY THE CYANIDATION OF THE CONCENTRATE

Since both flotation and direct cyanidation of the tailing sample resulted in high gold recoveries, it was considered appropriate to investigate the possibility of gold extraction by a combination of these two technologies, namely: flotation followed by the cyanidation of the flotation concentrate.

The combined process presents the following advantages versus the individual technologies:

Cyanidation of the flotation concentrate rather than that of the entire ore will result in a significant cost reduction for the cyanidation process because only a small fraction of the plant feed will undergo the cyanide leaching. Also cyanide leaching will produce a gold precipitate of much higher concentration in precious metals than that of the flotation product.

The flotation of the tailing sample to produce the required quantity of concentrate for the cyanidation tests was carried out under the optimum conditions.

The cyanidation of the flotation concentrate was performed after regrinding the material almost entirely, below 200 mesh (98.5% -80 μm) and for a duration of 48 hours. A cyanide leach test was also carried out using concentrate as resulted from the flotation (without regrind), but the metallurgical data were inconclusive and therefore were not reported. However there was an indication that the gold extraction for the unground concentrate was much lower than that obtained with reground product.

Actually the structure of the flotation concentrate (95.4% -80 µm), obtained under -65 mesh grinding conditions was not too much different from that of the reground concentrate (98.5% -80 µm). Complete screen analysis of the products are given in Table 15.

Table 15 - Structure of the flotation concentrate

Size		Without regrind			Reground		
Mesh (approx)	Microns	% Retained		% Pass Cum	% Retained		% Pass Cum
		Ind	Cum		Ind	Cum	
100	+ 160	0.1	0.1	99.9	-	-	100.0
150	100	1.9	2.0	98.0	0.5	0.5	99.5
200	80	2.6	4.6	95.4	1.0	1.5	98.5
250	50	9.9	14.5	85.5	7.3	8.8	91.2
400	32	9.6	24.1	75.9	8.5	17.3	82.7
400	-32	75.9	100.0	-	82.7	100.0	-
	Total	100.0	-	-	100.0	-	-

It is not clear how critical was the regrinding stage prior to cyanidation for achieving high gold extraction in the cyanide leaching process. Shortage of tailing sample made the verification of the cyanidation results with and without regrinding of the concentrate impossible. However, it is believed that a short regrind of the flotation concentrate prior to cyanidation will provide a good contact between the mineral particles and the cyanide solution ensuring a high gold extraction in the cyanidation stage. The effect of regrinding the concentrate on the cyanidation extraction will have to be investigated on the representative sample collected from the tailing pond, prior to the pilot-plant run.

The conditions and results of the flotation - cyanidation test are detailed in Appendix 5 and summarized in Table 16.

The reagent consumption for flotation and cyanidation of the concentrate is given in Table 17.

Table 16 - Results of combined flotation - cyanidation process

Process	Product	% Weight	Assay Au g/t or mg/ℓ	% Dist. Au	
				Ind	O/A
Flotation	Concentrate	9.1	21.65	92.7	
Cyanidation of conc	Cyanide Sol'n	-	2.92	96.0	
Combined process: flotation and cyanidation of the conc	Cyanide Sol'n	-	2.92		89.0
	Flot Tails	90.9	0.17		7.3
	Cyanide Residue	9.1	0.86		3.7
	Head (calc)	100.0	2.13		100.0

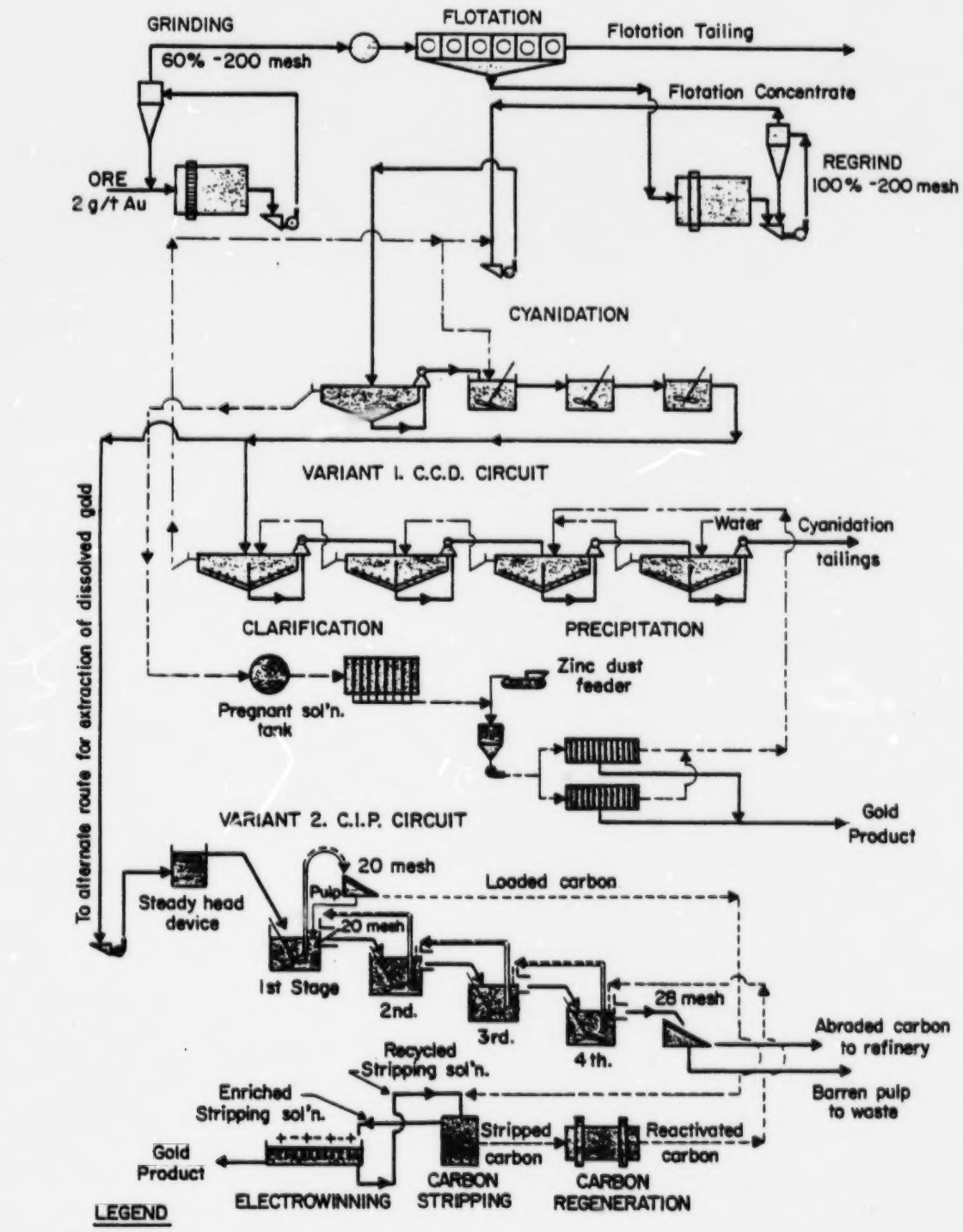
Table 17 - Reagent consumption for combined process

Process	Reagents		
	Type	g/t	
		Ind	O/A
Flotation	Aero 208	150	150
	Xanthate 301	75	75
	MIBC	78	78
Cyanidation of the conc	NaCN	1000	91
	CaO	11860	1079

ACKNOWLEDGEMENT

Grateful acknowledgement is extended to Chemical Laboratory, particularly the Ores and Fire Assay Section led by J.C. Hole for their important contribution to this project by carrying out a large volume of analyses and providing highly accurate results.

Figure 1. RECOMMENDED FLOWSHEET FOR PROCESSING FOREST HILL GOLD TAILINGS WITH 2 VARIANTS FOR EXTRACTION OF DISSOLVED GOLD



APPENDIX A
MINERALOGICAL REPORT

MINERAL PROCESSING LABORATORY

MINERALOGY SECTION

Report M - 3303

TITLE: Occurrence and mineralogy of gold from tailings samples, Forest Hill, Nova Scotia.

PROJECT NO.: 3.3.0.0.04 -"Precious Metals Recovery from Ores, Tailings and Residues".

SAMPLE: Five samples of tailings were submitted by M. Cristovici, MPL, who indicated that they had been collected from successive depths in the tailings pond and each assayed as follows:

TABLE 1

Sample #	Depth (?units)	Au g/t	Ag g/t
1	0-1	1.0	1.0
2	1-2	0.3-0.7	1.0
3	2-3	1.7-2.1	1-2
4	3-4	2.7-3.1	1.0

Sample #5 was a composite of equal amounts of each sample.

PREPARATION METHOD: A total of 30 polished sections were examined which were prepared from the various products of the preparation procedure outlined in Figure 1.

METHOD OF INVESTIGATION: All samples were examined in detail under the ore microscope in order to select grains of interest for examination. These grains were then examined and photographed in the SEM and their compositions were determined by electron microprobe techniques.

RESULTS: The sink products of the 3.3 S.G. heavy liquid separation contained the following opaque metallic minerals in decreasing order of abundance: arsenopyrite, pyrite, chalcopyrite, pyrrhotite, sphalerite and gold minerals. Table 2 presents modal data from the 4 primary specimens.

TABLE 2

MODAL DATA OF ORIGINAL SAMPLES

(visual estimates)

Specimen #	1	2	3	4
% opaque minerals	<5	<15	<20	<20
% arsenopyrite	80-90	75	75	75
% pyrite	5	5	5	5

.../2

Approved R.M. Buchanan Signed _____ Date Nov. 17/82

Section Head Mineralogy Section

Copies to: 1. M.A. Cristovici 2. P. Mainwaring 3. R.M. Buchanan

4. M.P.L. Files 5. Section Files 6. Section Files

In general, arsenopyrite has unoxidized, fresh grain margins while most gold or electrum grains are partially enclosed in a mixture of limonite and goethite. Pyrite occurs as fresh grains or as intergrowths with marcasite.

Gold: Gold or gold alloys were found in only six of the thirty polished sections examined, and these all from sink products of heavy liquid specific gravity 3.3. Table 3 contains detailed data on the occurrence and associations of the gold-bearing specimens.

TABLE 3

GENERAL DATA ON GOLD-BEARING GRAINS

SAMPLE #	3		4		
GRAIN #	1	2	1	2	3
Size (μm)	25x5	30x12	10x57	25x36	10x18
General Composition	Au,Ag	Au,Ag	Au,Ag	Au,Ag	Au,Ag
Surface Texture	well polished	irregular	cellular	cellular	cellular
Free or Locked	locked	free	free	free	free

As expected from the assay values provided, gold or gold alloys were found in specimens 3 and 4, from the deeper two of the four samples. The higher assays of sample #4 are reflected in the occurrence of gold or gold alloys in all heavy mineral separates collected from this specimen.

Only 1 grain of gold was observed (specimen #3; Figure 2) locked in a grain of quartz, the remainder occur as free grains.

Textures:

The two gold-bearing grains found in sample #3 differ markedly in their occurrence and texture. One grain which is locked in quartz (Figure 2) has a well-polished surface and is compositionally homogeneous. The other grain (Figure 5) has a highly pitted and irregular polished surface. Qualitative microprobe examination revealed that many of these cracks contain limonite or goethite.

The general 'spongy' or 'cellular' texture of most of the grains examined is well-illustrated by the grain shown in Figure 3. This grain is of interest since 1) the pits are not related to a softer, intergrown mineral as shown by the detail of Figure 4 which is a back-scattered electron micrograph, and therefore sensitive to differences in average atomic number and 3) there appears to be a rim or shell of the same composition electrum around the grain.

One grain of electrum in sample #4 contained a lamella intergrowth of a Bi-telluride located at only one end of the grain. No other Bi-tellurides were found.

Compositional Study

The compositions of gold-bearing grains were determined with the electron microprobe. All but one grain is gold-silver alloy (electrum) of varying proportions of gold and silver. As discussed above, most grains are cellular in nature and are therefore difficult to analyse. X-ray losses due to the holes in the surfaces averaged about 10% but reached 20% on a few parts of grains. In order to compensate for this, Au and Ag contents have been normalized to give combined totals of 100.0%. All grains were examined for the presence of other elements prior to quantitative analysis for Au and Ag. Compositional data is given in Table 4.

TABLE 4

COMPOSITIONS OF GOLD-BEARING GRAINS

(Averaged, Normalized)

	Ag	Au	Total	
Sample #3	4.1	97.1	101.2	
	1.2	98.8	100.0	(Normalized to 100.0)
Sample #4	3.1	97.0	100.0	(Normalized to 100.0)
	2.1	98.6	100.7	
	2.5	97.5	100.0	(Normalized to 100.0)

Conclusions:

1) Examination of the five samples submitted indicates that if the samples are representative, then most of the gold occurs as free grains of electrum, some of which are coated in limonite and goethite mixtures.

2) The minimum size of gold grains observed was 4 μm.

3) If these grains are representative, then the tailings could be processed by gravity and/or cyanidation.

4) Since locked grains of electrum do not appear to be cellullar in texture, this feature may derive from the former processing or reactions in the tailings ponds.

FIGURE 1 - SAMPLE PROCESSING

HOMOGENIZE ORIGINAL SAMPLE

REMOVE 200 g. SAMPLE
(prepare polished section)

PROCESS WITH 2.96 sp. gr. HEAVY LIQUID
(prepare 3 polished sections of float)

HAND MAGNETIC SEPARATION OF SINK PRODUCT
(prepare polished section)

PROCESS WITH 3.33 sp. gr. HEAVY LIQUID
(prepare polished section of float)

ELUTRIATE SINK PRODUCT
(prepare 3 polished sections of 3 successive sink products)

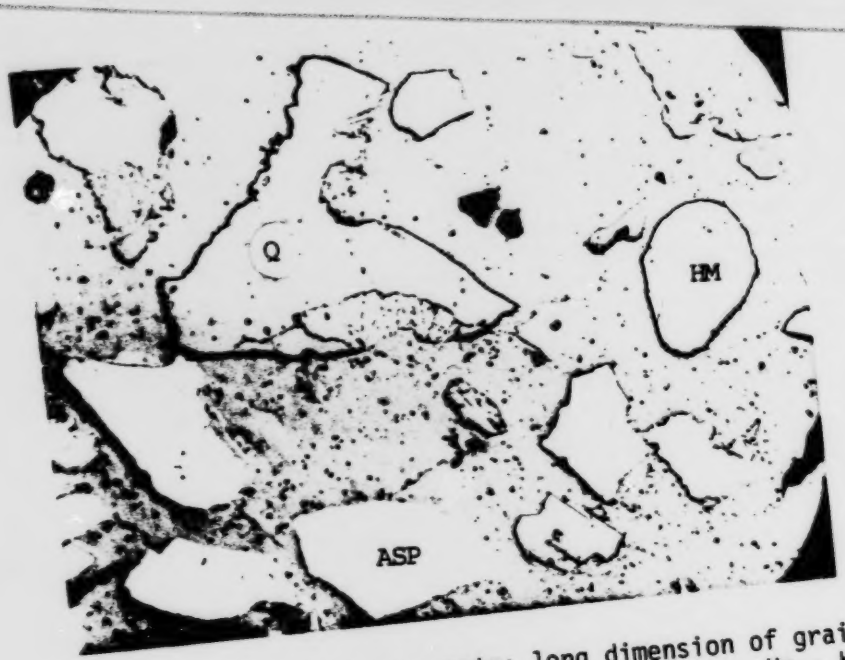


Figure 2: Electrum grain locked in quartz; long dimension of grain = 25 µm, reflected light, Sample #3. Asp - arsenopyrite, Hm - hematite, Q - quartz.

Figure 3: Grain of electrum exhibiting pronounced cellular texture; secondary electron image.

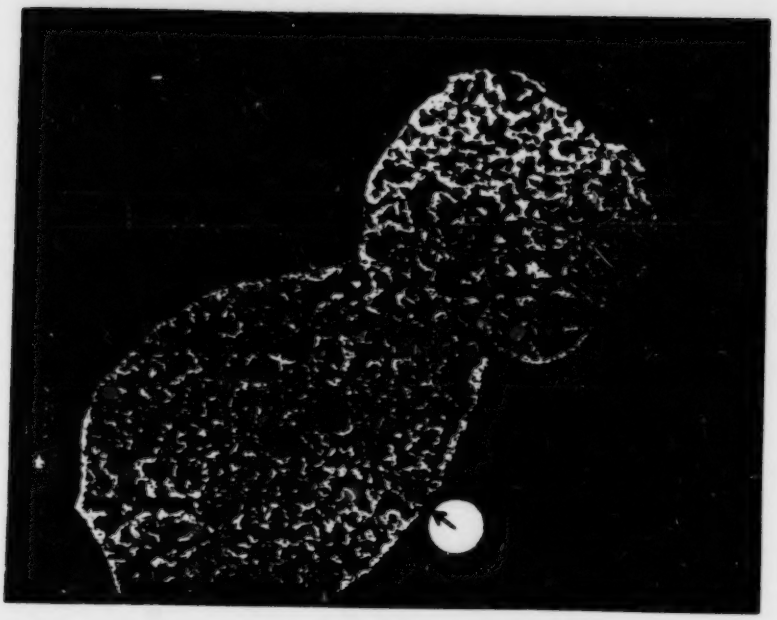


Figure 4: Same grain as Figure 3, back-scattered electron image, note rim and compositional uniformity.

Figure 5: Grain of irregular surfaced electrum, many cracks filled with goethite or limonite (L).

APPENDIX B
FLOTATION TEST 1-14

REAGENT REGIME

FLOTATION TEST REPORT

SAMPLE: Forest Hill Tailing composite — WEIGHT-GR.: 1000 — TEST NO.: 1

OBJECT OF TEST: Determine best reagents regime — DATE:

TEST BY:

OPERATION	Time Min.	% Solids	pH	Unit	Reagents - g/t 208	Reagents - g/t MIBC	GRIND Microns Size	GRIND Wt%
Grind	23	65					-80	74.6
Conditioning	3		6.3		100			
"	1					78		
Flot.Conc.-1	4.5							
Conditioning	3				50			
Flot.Conc.-2	4.5							

PRODUCT	Wt. GR.	Wt. %	ASSAYS g/t	METAL CONTENT	DISTRIBUTION - Au
Conc. 1+2		6.0	29.0		85.3
Rougher Tails		94.0	0.32		14.7
Head (calc.)		100.0	2.04		100.0

FLOTATION TEST REPORT

SAMPLE: Forest Hill Tailing composite — WEIGHT-GR.: 1000 — TEST NO.: 2

OBJECT OF TEST: Determine best reagents regime — DATE

TEST BY:

OPERATION	Time Min.	% Solids	pH	Unit	Reagents- g/t 208	301	MIBC	GRIND Microns Size	Wt.%
Grind	23	65						-80	74.6
Conditioning	3		6.5		100	50			
"	1						52		
Flot.Conc-1	4.5								
Conditioning	3				50	25			
"	1						26		
Flot.Conc -2	4.5								

PRODUCT	Wt. GR.	Wt. %	ASSAYS g/t Au	METAL CONTENT	DISTRIBUTION - Au
Conc 1 + 2		7.3	27.1		90.3
Rougher tails		92.7	0.23		9.7
Head (calc.)		100.0	2.19		100.0

FLOTATION TEST REPORT

SAMPLE: Forest Hill Tailing Sample

WEIGHT-GR.: 1000

TEST NO.: 3

OBJECT OF TEST: Determine best reagents regime

DATE:

TEST BY:

OPERATION	Time Min.	% Solids	pH	Unit	Reagents - g/t 208	317	MIBC	GRIND Size Microns	GRIND Wt%
Grinding	23	65						-80	74.6
Conditioning	3		6.5		100	50			
"	1						52		
Flot. Conc. 1	4.5								
Conditioning	3				50	25			
"	1						26		
Flot.Conc.-2	4.5								

PRODUCT	Wt. GR.	Wt. %	ASSAYS g/t Au	METAL CONTENT	DISTRIBUTION Au
Conc. 1		4.7	35.1		85.0
" 2		3.4	1.23		2.2
Rougher tails		91.9	0.27		12.8
Head (calc.)		100.0	1.94		
Conc 1+2		8.1	20.9		87.2

FLOTATION TEST REPORT

SAMPLE: Forest Hill Tailing Sample

WEIGHT-GR.: 1000

TEST NO.: 4

OBJECT OF TEST: Determine best reagents regime

DATE:

TEST BY:

OPERATION	Time Min.	% Solids	pH	Unit	Reagents - g/t 242	404	MIBC	GRIND Microns Size	GRIND Wt%
Grinding	23	65						-80	74.6
Conditioning	3		6.5		100	50			
"	1						52		
Flot.Conc-1	4.5								
Conditioning	3				50	25			
"	1						26		
Flot.Conc.-2	4.5								

PRODUCT	Wt. GR.	Wt. %	ASSAYS g/t	METAL CONTENT	DISTRIBUTION - % Au
Conc -1		15.2	13.3		90.8
" -2		6.7	0.73		2.2
Rougher tails		78.1	0.20		7.0
Head (calc)		100.0	2.2		100.0
Conc 1+2		21.9	9.5		93.0

FLOTATION TEST REPORT

SAMPLE: Forest Hill Tailing Sample — WEIGHT-GR.: 1000 — TEST NO.: 5

OBJECT OF TEST: Determine best reagents regime — DATE:

TEST BY:

OPERATION	Time Min.	% Solids	pH	Unit	Reagents - g/t 242	317	MIBC	GRIND Micron Size	GRIND Wt%
Grinding	23	65						-80	74.6
Conditioning	3		6.5		100	50			
"	1						52		
Flot.Conc.-1	4.5								
Conditioning	3				50	25			
"	1						26		
Flot. Conc.-2	4.5								

PRODUCT	Wt. GR.	Wt. %	ASSAYS g/t Au	METAL CONTENT	DISTRIBUTION - Au
Conc.-1		13.6	14.9		90.2
" -2		8.3	0.67		2.5
Rougher tails		78.1	0.21		7.3
Head (calc.)		100.0	2.2		100.0
Conc 1+2		21.9	9.5		92.7

FLOTATION TEST REPORT

SAMPLE: Forest Hill Tailing sample. WEIGHT-GR.:

TEST NO.: 6

OBJECT OF TEST: Repeat condition of Test #2 and determine to need for collecting the second concentrate. Also assay concentrates for Ag and S.

DATE:

TEST BY:

OPERATION	Time Min.	% Solids	pH	Unit	Reagents - g/t 208	301	MIBC	GRIND Micron Size	Wt.%
Grinding	23	65						-80	74.6
Conditioning	3		6.5		100	50			
"	1						52		
Flot.Conc-1	4.5								
Conditioning	3				50	25			
"	1						26		
Flot. Conc-2	4.5								

PRODUCT	Wt. GR.	Wt. %	ASSAYS g/t Au	Ag	S%	METAL CONTENT	DISTRIBUTION - % Au	Ag	S
Conc -1		4.8	39.5	5.03	10.28		88.2	46.9	89.3
" -2		2.8	3.11	1.50	0.78		4.1	8.2	4.0
Rougher tails		92.4	0.18	0.25	0.04		7.7	44.9	6.7
Head (calc.)		100.0	2.15	0.51	0.55		100.0	100.0	100.0
Conc 1+2		7.6	26.1	3.72	6.78		92.3	55.1	93.3

FLOTATION TEST REPORT

SAMPLE: Forest Hill Tailing sample WEIGHT-GR.: 1000 x 2 TEST NO.: 7

OBJECT OF TEST: Determine optimum consumption using reagents of Test #2 DATE:

TEST BY:

OPERATION	Time Min.	% Solids	pH	Unit	Reagents - g/t 208	301	MIBC	GRIND Microns Size	Wt%
Grind	23	65						-80	74.6
Conditioning	3		6.5		50	25			
"	1						52		
Flot.Conc-1	4.5								
Conditioning	3				25	13			
"	1						26		
Flot.Conc-2	4.5								

PRODUCT	Wt. GR.	Wt. %	ASSAYS g/t Au	METAL CONTENT	DISTRIBUTION Au
Conc.-1		3.2	51.2		84.2
" -2		2.1	4.73		5.1
Rougher tails		94.7	0.22		10.7
Head (calc.)		100.0	1.95		100.0
Conc. 1+2		5.3	32.8		89.3

FLOTATION TEST REPORT

SAMPLE: Forest Hill Tailing sample

WEIGHT-GR.: 1000 x 2

TEST NO.: 8

DATE:

TEST BY:

OBJECT OF TEST: Determine optimum consumption using reagents of Test #2

OPERATION	Time Min.	% Solids	pH	Unit	Reagents - g/t			GRIND	
					208	301	MIBC	Microns Size	Wt.%
Grinding	23	65						-80	74.6
Conditioning	3		6.5		25	12.5			
"	1						52		
Flot.Conc 1	4 1/2								
Conditioning	3				25	12.5			
"	1						26		
Flot.Conc. 2	4 1/2								

PRODUCT	Wt. GR.	Wt. %	ASSAYS g/t	METAL CONTENT	DISTRIBUTION
			Au		Au
Conc 1		3.1	48.5		82.8
Conc 2		2.7	3.92		5.8
Rougher tail		94.2	0.22		11.4
Feed (calc.)		100.0	1.82		100.0
Conc 1+2		5.8	27.8		88.6

FLOTATION TEST REPORT

SAMPLE: Forest Hill Tailing sample. WEIGHT-GR.: 1000 TEST NO.: 9

OBJECT OF TEST: Determine best reagents regime DATE:

TEST BY:

OPERATION	Time Min.	% Solids	pH	Unit	Reagents - g/t 301	3477	MIBC	GRIND Microns Size	GRIND Wt %
Grinding	23	65						-80	74.6
Conditioning	3		6.5		50	100			
"	1						52		
Flot.Conc.1	4 1/2								
Conditioning	3				25	50			
"	1						12.5		
Flot. Conc. 2	4 1/2								

PRODUCT	Wt. GR.	Wt. %	ASSAYS g/t Au	METAL CONTENT	DISTRIBUTION Au
Conc -1		7.1	26.4		90.4
Conc -2		3.5	1.63		2.7
Rougher tail		89.4	0.16		6.9
Feed (calc.)		100.0	2.07		100.0
Conc 1+2		10.6	18.2		93.1

FLOTATION TEST REPORT

SAMPLE: Forest Hill Tailing sample — WEIGHT-GR.: 1000 — TEST NO.: 10

OBJECT OF TEST: Determine best reagents regime — DATE:

TEST BY:

OPERATION	Time Min.	% Solids	pH	Unit	Reagents - g/t 3477	317	MIBC	GRIND Microns Size	Wt %
Grinding	23	65						-80	74.6
Conditioning	3		6.5		100	50			
"	1						52		
Flot.Conc 1	4 1/2								
Conditioning	3				50	25			
"	1								
Flot.Conc. -2	4 1/2								

PRODUCT	Wt. GR.	Wt. %	ASSAYS g/t Au	METAL CONTENT	DISTRIBUTION Au
Conc -1		7.6	22.9		89.2
Conc -2		3.0	2.29		3.5
Rougher tail		89.4	0.18		7.3
Feed (calc.)		100.0	1.95		100.0
Conc. 1+2		10.6	17.1		92.7

FLOTATION TEST REPORT

SAMPLE: Forest Hill Tailing sample. WEIGHT-GR.: 1000 TEST NO.: 11

OBJECT OF TEST: Determine best reagents regime DATE:

TEST BY:

OPERATION	Time Min.	% Solids	pH	Unit	Reagents - g/t 3501	301	MIBC	GRIND Microns Size	Wt %
Grinding	23	65						-80	74.6
Conditioning	3		6.5		100	50			
"	1						52		
Flot.Conc. 1	4 1/2								
Conditioning	3				50	25			
"	1						26		
Flot.Conc. 2	4 1/2								

PRODUCT	Wt. GR.	Wt. %	ASSAYS g/t Au	METAL CONTENT	DISTRIBUTION % Au
Conc -1		6.5	26.8		88.0
Conc. -2		3.8	2.0		3.8
Rougher tail		89.7	0.18		8.2
Feed (calc.)		100.0	1.98		100.0
Conc 1+2		10.3	17.7		91.8

FLOTATION TEST REPORT

SAMPLE: Forest Hill Tailing sample WEIGHT-GR.: 1000 TEST NO.: 12

OBJECT OF TEST: Determine best reagents regime DATE:

TEST BY:

OPERATION	Time Min.	% Solids	pH	Unit	Reagents - g/t 3501	317	MIBC	GRIND Mesh	GRIND Wt %
Grinding	23	65						-80	74.6
Conditioning	3		6.5		100	50			
"	1						52		
Flot.Conc.1	4 1/2								
Conditioning	3				50	25			
"	1						26		
Flot.Conc.2	4 1/2								

PRODUCT	Wt. GR.	Wt. %	ASSAYS g/t Au	METAL CONTENT	DISTRIBUTION - Au
Conc -1		5.4	30.2		86.4
Conc -2		3.2	2.87		4.9
Rougher tail		91.4	0.18		8.7
Feed (calc.)		100.0	1.89		100.0
Conc 1+2		8.6	20.0		91.3

FLOTATION TEST REPORT

SAMPLE: Forest Hill Tailing Sample

OBJECT OF TEST: Determine best reagents regime

WEIGHT-GR.: 1000

TEST NO.: 13

DATE:

TEST BY:

OPERATION	Time Min.	% Solids	pH	Unit	Reagents - g/t 404	301	MIBC
Grinding	23	65					
Conditioning	3		6.5		100	50	
"	1						
Flot.Conc.-1	4 1/2						52
Conditioning	3				50	25	
"	1						
Flot.Conc. -2	4 1/2						26

GRIND

Microns Size	Wt %
-80	74.6

PRODUCT	Wt. GR.	Wt. %	ASSAYS g/t Au	METAL CONTENT	DISTRIBUTION - Au
Conc 1+2		4.2	38.4		88.9
Rougher tail		95.8	0.21		11.1
Feed (calc.)		100.0	1.81		100.0

FLOTATION TEST REPORT

SAMPLE: Forest Hill Tailing Sample — WEIGHT-GR.: 1000 — TEST NO.: 14

OBJECT OF TEST: Determine optimum reagents regime — DATE:

TEST BY:

OPERATION	Time Min.	% Solids	pH	Unit	Reagents - g/t 404	317	MIBC	GRIND Microns Size	GRIND Wt%
Grinding	23	65						-80	74.6
Conditioning	3		6.5		100	50			
Flot.Conc. 1	4 1/2						52		
Conditioning	3				50	25			
Flot.Conc. 2	4 1/2						26		

PRODUCT	Wt. GR.	Wt. %	ASSAYS g/t Au	METAL CONTENT	DISTRIBUTION Au
Conc 1+2		4.2	39.8		87.9
Rougher tails		95.8	0.24		12.1
Feed (calc.)		100.0	1.90		100.0

APPENDIX C
FLOTATION TESTS 20-23

VARIOUS GRINDINGS

FLOTATION TEST REPORT

SAMPLE: Forest Hill Tailing Sample WEIGHT-GR.: 1000 TEST NO.: 20

OBJECT OF TEST: Determine optimum grind for the flotation (-100 mesh grind) DATE:

TEST BY:

OPERATION	Time Min.	% Solids	pH	Unit	Reagents- g/t			GRIND	
					208	301	MIBC	Microns Size	Wt%
Grinding	23	65						-80	74.6
Conditioning	3		6.5		100	50			
"	1						56		
Flot.Conc.-1	4 1/2								
Conditioning	3				50	25			
"	1						26		
Flot.Conc -2	4 1/2								

PRODUCT	Wt. GR.	Wt. %	ASSAYS g/t	METAL CONTENT	DISTRIBUTION
			Au		Au
Conc -1		5.5	37.0		89.5
Conc -2		3.1	1.82		2.5
Rougher tails		91.4	0.20		8.0
Feed (calc.)		100.0	2.27		100.0
Conc 1+2		8.6	24.3		92.0

FLOTATION TEST REPORT

SAMPLE: Forest Hill Tailing Sample WEIGHT-GR.: 1000 TEST NO.: 21

OBJECT OF TEST: Determine optimum grind for flotation (No grind) DATE:

TEST BY:

OPERATION	Time Min.	% Solids	pH	Unit	Reagents- g/t 208	301	MIBC	GRIND Microns Size	Wt%
Conditioning	3		6.5		100	50		-80	20.0
"	1						56		
Flot.Conc. 1	4 1/2								
Conditioning	3				50	25			
"	1						26		
Flot.Conc. 2	4 1/2								

PRODUCT	Wt. GR.	Wt. %	ASSAYS g/t Au	METAL CONTENT	DISTRIBUTION - Au
Conc 1+2		3.8	39.8		82.6
Rougher tail		96.2	0.33		17.4
Feed (calc.)		100.0	1.83		100.0

FLOTATION TEST REPORT

SAMPLE: Forest Hill Tailing Sample WEIGHT-GR.: 1000 TEST NO.: 22

OBJECT OF TEST: Determine optimum grind for flotation (-65 mesh grind) DATE:

TEST BY:

OPERATION	Time Min.	% Solids	pH	Unit			Reagents - g/t 208	301	MIBC	GRIND Size Microns	GRIND Wt %
Grinding	15	65								-80	60.0
Conditioning	3	6.5					100	50			
"	1								56		
Flot. Conc. 1	4 1/2										
Conditioning	3						50	25			
"	1								26		
Flot. Conc. 2	4 1/2										

PRODUCT	Wt. GR.	Wt. %	ASSAYS g/t Au	METAL CONTENT	DISTRIBUTION Au
Conc -1		6.1	28.8		88.2
Conc.-2		3.0	2.65		4.0
Rougher tail		90.9	0.17		7.8
Feed (calc.)		100.0	2.0		100.0
Conc 1+2		9.1	20.2		92.2

FLOTATION TEST REPORT

SAMPLE: Forest Hill Tailing Sample WEIGHT-GR.: 1000 TEST NO.: 23

OBJECT OF TEST: Determine optimum grind for flotation (-200 mesh grind) DATE:

TEST BY:

OPERATION	Time Min.	% Solids	pH	Unit	Reagents - g/t 208	301	MIBC	GRIND Micron Size	GRIND Wt %
Grinding	50	65						-80	97.5
Conditioning	3		6.5		100	50			
"	1						56		
Flot.Conc. 1	4 1/2								
Conditioning	3				50	25			
"	1						26		
Flot. Conc. 2	4 1/2								

PRODUCT	Wt. GR.	Wt. %	ASSAYS g/t Au	METAL CONTENT	DISTRIBUTION % Au
Conc -1		6.0	32.2		90.0
Conc -2		8.8	0.9		3.7
Rugher tail		85.2	0.16		6.3
Feed (calc.)		100.0	2.15		100.0
Conc 1+2		14.8	13.6		93.7

APPENDIX D
CYANIDATION TESTS:

102A,B
103A,B
114-116
118A,B
119B
120A,B
121A,B
122A

TEST NUMBER 102A

CYANIDATION TEST RECORD

Object of Test: Determine optimum cyanidation conditions

Sol'n Conc. 1.0 g/ℓ NaCN

Feed: 500 g

Pulp Density: 33 % solids

Sol'n Vol. 1000 ml

Fineness: - 100 mesh

Hours 12

Forest Hill Tailing Sample

Regents Balance

Time Cumul. hrs	ADDED GRAMS ACTUAL NaCN	ADDED GRAMS ACTUAL $Ca(OH)_2$	ADDED GRAMS EQUIVALENT NaCN	ADDED GRAMS EQUIVALENT CaO	RESIDUAL g NaCN	RESIDUAL g CaO	CONSUMED g NaCN	CONSUMED g CaO	PH
Start	1.05	4.00	1.00	2.92					12.38
2					0.90	0.60	0.10	2.32	
	0.105		0.10						11.73
6					0.95	0.53	0.05	0.07	
	0.052		0.05						
12					0.90	0.50	0.10	0.03	11.75
Total	1.207	4.00	1.15	2.92	0.90	0.50	0.25	2.42	

Cyanide sol'n: 780 ml
Wash sol'n: 980 ml
Residue: 495.0 g

Reagents Consumption: Kg/t

NaCN: 0.50
CaO: 4.84

CYANIDATION TEST RESULTS

WEIGHT-GR.:

TEST NO.: 102 A

...T OF TEST:

DATE:

TEST BY:

OPERATION	Time Min.	% Solids	pH	Unit			Reagents - lbs/ton											GRIND Size	GRIND Wt.%	REMARKS

PRODUCT	Amount		ASSAYS g/t or mg/l							METAL CONTENT							DISTRIBUTION - %							
			Au														Au							
Cyanide Sol'n	ml	780	0.86														64.5	)						
Wash	ml	980	0.18														17.0	)81.5						
Residue	g	495	0.39														18.5							
Head (calc.)			2.10														100.0							

CYANIDATTON TEST RECORD

TEST NUMBER 102B

Object of Test: Determine optimum cyanidation conditions

Sol'n Conc. 1.0 g/l NaCN

Feed: 500 g;

Pulp Density: 33 % solids

Sol'n Vol. 1000 ml

Fineness: -100 mesh

Hours 12

Forest Hill Tailing Sample

Regents Balance

Time Cumul. hrs	ADDED GRAMS ACTUAL NaCN	ADDED GRAMS ACTUAL $Ca(OH)_2$	ADDED GRAMS EQUIVALENT NaCN	ADDED GRAMS EQUIVALENT CaO	RESIDUAL g NaCN	RESIDUAL g CaO	CONSUMED g NaCN	CONSUMED g CaO	PH
Start	1.05	4.00	1.00	2.92					12.35
2					0.90	0.62	0.10	2.30	
	0.105		0.10						11.78
6					0.95	0.52	0.05	0.10	
	0.052		0.05						
12					0.95	0.50	0.05	0.02	11.66
Total	1.207	4.00	1.15	2.92	0.95	0.50	0.20	2.42	

Cyanide sol'n: 760 ml
Wash sol'n: 920 ml
Residue: 513.2 g

Reagents Consumption: Kg/t

NaCN: 0.40
CaO: 4.84

CYANIDATION TEST RESULTS

WEIGHT-GR.:

TEST NO.: 102 B

DATE:

TEST BY:

OPERATION	Time Min.	% Solids	pH	Unit	Reagents - lbs/ton	GRIND Size	GRIND Wt.%	REMARKS

PRODUCT	Amount		ASSAYS g/t or mg/l Au	METAL CONTENT	DISTRIBUTION - % Au
Cyanide Sol'n	ml	760	1.00		64.3)
Wash "	ml	920	0.23		17.9)82.2
Residue	g	513.2	0.41		17.8
Head (calc.)			2.30		100.0

TEST NUMBER 103A

CYANIDATION TEST RECORD

Object of Test: Determine optimum cyanidation conditions

Sol'n Conc. 1.0 g/ℓ NaCN

Feed: 500 g;

Pulp Density: 33 % solids

Sol'n Vol. 1000 ml

Fineness: -100 mesh

Hours 24

Forest Hill Tailing Sample

Regents Balance _____

Time Cumul. hrs	ADDED GRAMS ACTUAL NaCN	ADDED GRAMS ACTUAL $Ca(OH)_2$	ADDED GRAMS EQUIVALENT NaCN	ADDED GRAMS EQUIVALENT CaO	RESIDUAL g NaCN	RESIDUAL g CaO	CONSUMED g NaCN	CONSUMED g CaO	PH
Start	1.05	5.00	1.00	3.65					11.60
3					0.90	0.70	0.10	2.95	11.81
	.105		0.10						
11					0.95	0.63	0.05	0.07	12.45
	052		.05						
24					0.95	0.59	0.05	0.04	12.70
Total	1.207	5.00	1.15	3.65	0.95	0.59	0.20	3.06	

Cyanide sol'n: 735 ml
Wash sol'n: 970 ml
Residue: 516.7 g

Reagents Consumption: Kg/t

NaCN: 0.40
CaO: 6.12

CYANIDATION TEST RESULTS

SAMPLE: WEIGHT-GR.: TEST NO.: 103 A

PURPOSE OF TEST: DATE:

TEST BY:

AGITATION	Time Min.	% Solids	pH	Unit			Reagents - lbs/ton											GRIND Size	GRIND Wt.%	REMARKS

PRODUCT	Amount		ASSAYS g/t or mg/l Au	METAL CONTENT	DISTRIBUTION - % Au	
Cyanide Sol'n	ml	735	0.99		68.3	)
Wash "	ml	970	0.22		20.0	)88.3
Residue	g	516.7	0.24		11.7	
Head (calc.)			2.06		100.0	

TEST NUMBER 103B

CYANIDATION TEST RECORD

Object of Test: Determine optimum cyanidation conditions

Sol'n Conc. 1.0 g/ℓ NaCN

Feed: 500 g;

Pulp Density: 33 % solids

Sol'n Vol. 1000 ml

Fineness: -100 mesh

Hours 24

Forest Hill Tailings Sample

Regents Balance

Time Cumul. hrs	ADDED GRAMS ACTUAL NaCN	ADDED GRAMS ACTUAL $Ca(OH)_2$	ADDED GRAMS EQUIVALENT NaCN	ADDED GRAMS EQUIVALENT CaO	RESIDUAL g NaCN	RESIDUAL g CaO	CONSUMED g NaCN	CONSUMED g CaO	pH
Start	1.05	5.00	1.00	3.65					11.65
3					0.90	0.70	0.10	2.95	11.83
	0.105		0.10						
11					0.95	0.66	0.05	0.04	12.46
	0.052		0.05						
24					0.95	0.57	0.05	0.09	12.30
Total	1.207	5.00	1.15	3.65	0.95	0.57	0.20	3.08	

Cyanide sol'n: 810 ml
Wash sol'n: 990 ml
Residue: 495.5 g

Reagents Consumption: Kg/t

NaCN: 0.40
CaO: 6.16

CYANIDATION TEST RESULTS

WEIGHT-GR.:

TEST NO.: 103 B

CT OF TEST:

DATE:

TEST BY:

OPERATION	Time Min.	% Solids	pH	Unit			Reagents - lbs/ton												GRIND Size	GRIND Wt.%	REMARKS

PRODUCT	Amount		ASSAYS g/t or mg/l Au	METAL CONTENT	DISTRIBUTION - % Au	
Cyanide Sol'n	ml	810	0.89		61.5	
Wash "	ml	990	0.17		14.4	75.9
Residue	g	495.5	0.57		24.1	
Head (calc.)			2.36		100.0	

CYANIDATION TEST RECORD

TEST NUMBER 114

Object of Test: Determine optimum cyanidation conditions

Feed: 500 g;

Sol'n Vol. 1000 ml

Hours 48

Sol'n Conc. 1.0 g/l NaCN

Pulp Density: 33 % solids

Fineness: -100 mesh

Forest Hill Tailings Sample

Regents Balance

Time Cumul. hrs	ADDED GRAMS ACTUAL NaCN	ADDED GRAMS ACTUAL $Ca(OH)_2$	ADDED GRAMS EQUIVALENT NaCN	ADDED GRAMS EQUIVALENT CaO	RESIDUAL g NaCN	RESIDUAL g CaO	CONSUMED g NaCN	CONSUMED g CaO	PH
Start	1.05	3.5	1.00	2.56					11.9
2					0.80	0.45	0.20	2.11	11.96
	0.210		0.20						
10					0.90	0.37	0.10	0.08	11.80
	0.105		0.10						
24					0.90	0.24	0.10	0.13	11.70
	0.105		0.10						
34	0.105		0.10		0.90	0.20	0.10	0.04	11.65
48					1.00	0.20		0.00	11.1
Total	1.575	3.5	1.50	2.56	1.00	0.20	0.50	2.36	

Cyanide sol'n: 780 ml
Wash sol'n: 1020 ml
Residue: 492.4 g

Reagents Consumption: Kg/t

NaCN: 1.00
CaO: 4.72

CYANIDATION TEST RESULTS

WEIGHT-GR.:

TEST NO.: 114

OBJECT OF TEST:

DATE:

TEST BY:

AGITATION	Time Min.	% Solids	pH	Unit			Reagents - lbs/ton											GRIND Size	GRIND Wt.%	REMARKS

PRODUCT	Amount		ASSAYS g/t or mg/l Au	METAL CONTENT	DISTRIBUTION - % Au	
Cyanide Sol'n	780.0	ml	0.96		74.5	)90.7
Water Wash	1020.0	ml	0.16		16.2	
Residue	492.4	g	0.19		9.3	
Head (calc.)			2.04		100.0	

TEST NUMBER 115

CYANIDATION TEST RECORD

Object of Test: Determine optimum cyanidation conditions

Feed: 500 g;

Sol'n Vol. 1000 ml

Hours 24

Forest Hill Tailings Sample

Sol'n Conc. 1.0 g/l NaCN

Pulp Density: 33 % solids

Fineness:

Regents Balance

Time Cumul. hrs	ADDED GRAMS ACTUAL NaCN	ADDED GRAMS ACTUAL $Ca(OH)_2$	ADDED GRAMS EQUIVALENT NaCN	ADDED GRAMS EQUIVALENT CaO	RESIDUAL g NaCN	RESIDUAL g CaO	CONSUMED g NaCN	CONSUMED g CaO	PH
Start	1.05	3.00	1.00	2.19					12.03
2					0.95	0.54	0.05	1.65	12.00
	0.052		0.05						
6					1.00	0.46		0.08	11.85
12					1.00	0.33		0.13	11.70
24					1.00	0.27		0.06	11.50
Total	1.102	3.00	1.05	2.19	1.00	0.27	0.05	1.92	

Cyanide sol'n: 820 ml
Wash sol'n: 1030 ml
Residue: 497.2 g

Reagents Consumption: Kg/t

NaCN: 0.100
CaO: 3.84

CYANIDATION TEST RESULTS

WEIGHT-GR.:

TEST NO.: 115

DATE:

TEST BY:

OPERATION	Time Min.	% Solids	pH	Unit			Reagents - lbs/ton											GRIND		REMARKS
																		Size	Wt.%	

PRODUCT	Amount		ASSAYS g/t or mg/l							METAL CONTENT							DISTRIBUTION - %						
			Au														Au						
Cyanide Sol'n	820	ml	0.82														68.7	)					
Wash	1030	ml	0.10														10.5	)79.2					
Residue	497.2	g	0.41														20.8						
Head (calc.)			1.97														100.0						

CYANIDATION TEST RECORD

TEST NUMBER 116

Object of Test: Determine optimum cyanidation conditions

Feed: 500 g;

Sol'n Vol. 1000 ml

Hours 24

Sol'n Conc. 1.0 g/l NaCN

Pulp Density: 33 % solids

Fineness: -65 mesh

Forest Hill Tailing Sample

Regents Balance

Time Cumul. hrs	ADDED GRAMS ACTUAL NaCN	ADDED GRAMS ACTUAL $Ca(OH)_2$	ADDED GRAMS EQUIVALENT NaCN	ADDED GRAMS EQUIVALENT CaO	RESIDUAL g NaCN	RESIDUAL g CaO	CONSUMED g NaCN	CONSUMED g CaO	PH
Start	1.05	2.5	1.00	1.83					12.00
2					0.90	0.17	0.10	1.66	11.61
	.104	.50	.10	0.37					
6					1.00	0.16		0.38	11.50
12					1.00	0.15		0.01	11.45
24					1.00	0.12		0.03	10.7
Total	1.154	3.00	1.10	2.20	1.00	0.12	0.10	2.08	

Cyanide sol'n: 810 ml
Wash sol'n: 1020 ml
Residue: 496.3 g

Reagents Consumption: Kg/t

NaCN: 0.2
CaO: 4.16

CYANIDATION TEST RESULTS

OF TEST:

WEIGHT - GR.:

TEST NO.: 116

DATE:

TEST BY:

...ENTATION	Time Min.	% Solids	pH	Unit			Reagents - lbs/ton											GRIND		REMARKS
																		Size	Wt.%	

TEST NUMBER 118A

CYANIDATION TEST RECORD

Object of Test: Determine optimum cyanidation conditions

Feed: 500 g;

Sol'n Vol. 1000 ml

Hours 48

Forest Hill Tailings Sample

Sol'n Conc. 1.0 g/l NaCN

Pulp Density: 33 % solids

Fineness:

Grind: none

Regents Balance

Time Cumul. hrs	ADDED GRAMS ACTUAL NaCN	ADDED GRAMS ACTUAL $Ca(OH)_2$	ADDED GRAMS EQUIVALENT NaCN	ADDED GRAMS EQUIVALENT CaO	RESIDUAL g NaCN	RESIDUAL g CaO	CONSUMED g NaCN	CONSUMED g CaO	PH
Start	1.05	3.50	1.00	2.56					
3					0.70	0.25	0.30	2.31	12.27
	0.32		0.30						
6					1.00	0.25			12.20
12					1.00	0.25			12.17
24					1.00	0.25			12.13
36					1.00	0.02		0.23	10.99
		0.50		0.37					
48					1.00	0.30		0.09	12.33
Total	1.37	4.00	1.30	2.93	1.00	0.30	0.30	2.63	

Cyanide sol'n: 860 ml
Wash sol'n: 970 ml
Residue: 500.6 g

Reagents Consumption: Kg/t

NaCN: 0.60
CaO: 5.54

CYANIDATION TEST RECORD

TEST NUMBER 118B

Object of Test: Determine optimum cyanidation conditions

Feed: 500 g;

Sol'n Vol. 1000 ml

Hours 48

Sol'n Conc. 1.0 g/l NaCN

Pulp Density: 33 % solids

Fineness:

Grind: none

Forest Hill Tailings Sample

Regents Balance

Time Cumul. hrs	ADDED GRAMS ACTUAL NaCN	ADDED GRAMS ACTUAL $Ca(OH)_2$	ADDED GRAMS EQUIVALENT NaCN	ADDED GRAMS EQUIVALENT CaO	RESIDUAL g NaCN	RESIDUAL g CaO	CONSUMED g NaCN	CONSUMED g CaO	PH
Start	1.05	3.50	1.00	2.56					
3					0.70	0.27	0.30	2.29	12.27
	0.32		0.30						
6					1.00	0.27			12.23
12					1.00	0.27			12.19
24					1.00	0.27			11.66
36					1.00	0.03		0.24	10.89
		0.50		0.37					
48					1.00	0.29		0.11	11.09
Total	1.37	4.00	1.30	2.93	1.00	0.29	0.30	2.64	

Cyanide sol'n: 820 ml
Wash sol'n: 870 ml
Residue: 500 g

Reagents Consumption: Kg/t

NaCN: 0.60
CaO: 5.62

CYANIDATION TEST RESULTS

WEIGHT-GR.:

TEST NO.: 118 A, 118 B

DATE:

TEST BY:

APPLICATION	Time Min.	% Solids	pH	Unit			Reagents - lbs/ton											GRIND Size	GRIND Wt.%	REMARKS

PRODUCT	Wt. GR Amount	Wt. %	ASSAYS g/t or mg/l Au	METAL CONTENT	DISTRIBUTION - % Au	
A. Cyanide Sol'n	860	ml	1.03		82.5	
Wash "	970	ml	0.095		8.6	91.1
Residue	500.6	g	0.18		8.9	
Head (calc.)			2.14		100.0	
B. Cyanide Sol'n	820	ml	1.08		74.8	
Wash "	870	ml	0.20		14.7	89.5
Residue	500	g	0.25		10.5	
Head (calc.)			2.37		100.0	

TEST NUMBER 119 B

CYANIDATION TEST RECORD

Object of Test: Determine optimum cyanidation conditions

Sol'n Conc. 1.0 g/ℓ NaCN

Feed: 500 g;

Pulp Density: 33 % solids

Sol'n Vol. 1000 ml

Forest Hill Tailing Sample

Fineness: -65 mesh

Hours 48

Regents Balance

Time Cumul. hrs	ADDED GRAMS ACTUAL NaCN	ADDED GRAMS ACTUAL $Ca(OH)_2$	ADDED GRAMS EQUIVALENT NaCN	ADDED GRAMS EQUIVALENT CaO	RESIDUAL g NaCN	RESIDUAL g CaO	CONSUMED g NaCN	CONSUMED g CaO	pH
Start	1.05	3.50	1.00	2.56					
6					0.85	0.57	0.15	1.99	12.01
	0.158		0.15						
11					1.00	0.55		0.02	12.26
24					1.00	0.06		0.49	11.33
		0.50		0.37					
36					1.00	0.33		0.10	12.10
48					1.00	0.06		0.27	11.33
Total	1.208	4.00	1.15	2.93	1.00	0.06	0.15	2.87	

Cyanide sol'n: 620 ml
Wash sol'n: 980 ml
Residue: 501.2 g

Reagents Consumption: Kg/t

NaCN: 0.300
CaO: 5.74

CYANIDATION TEST RESULTS

WEIGHT-GR.:

TEST NO.: 119 B

DATE:

TEST BY:

OF TEST:

OPERATION	Time Min.	% Solids	pH	Unit			Reagents - lbs/ton												GRIND Size	GRIND Wt%	REMARKS

PRODUCT	Wt. Amount	Wt. %	ASSAYS g/t or mg/l Au							METAL CONTENT							DISTRIBUTION - % Au							
Cyanide Sol'n	620	ml	1.14														70.8							
Wash "	980	ml	0.20														19.7	90.5						
Residue	501.2	g	0.19														9.5							
Head (calc)			1.99														100.0							

TEST NUMBER 120 A

CYANIDATION TEST RECORD

Object of Test: Determine optimum cyanidation conditions

Sol'n Conc. 1.0 g/l NaCN

Feed: 500 g;

Pulp Density: 33 % solids

Sol'n Vol. 1000 ml

Fineness: -100 mesh

Hours 48

Forest Hill Tailings Sample

Regents Balance

Time Cumul. hrs	ADDED GRAMS ACTUAL NaCN	ADDED GRAMS ACTUAL $Ca(OH)_2$	ADDED GRAMS EQUIVALENT NaCN	ADDED GRAMS EQUIVALENT CaO	RESIDUAL g NaCN	RESIDUAL g CaO	CONSUMED g NaCN	CONSUMED g CaO	PH
Start	1.05	4.00	1.00	2.92					
3					0.85	0.60	0.15	2.32	12.6
	0.158		0.15						
6					0.85	0.50	0.15	0.10	12.5
	0.158		0.15						
12					1.00	0.41		0.09	12.36
24					1.00	0.35		0.06	12.27
36					1.00	0.24		0.11	12.21
48					1.00	0.19		0.05	12.10
Total	1.366	4.00	1.30	2.92	1.00	0.19	0.30	2.73	

Cyanide sol'n: 860 ml
Wash sol'n: 1000 ml
Residue: 499.6 g

Reagents Consumption: Kg/t

NaCN: 0.60
CaO: 5.46

TEST NUMBER 120 B

CYANIDATION TEST RECORD

Object of Test: Determine optimum cyanidation conditions

Feed: 500 g;

Sol'n Vol. 1000 ml

Hours 48

Sol'n Conc. 1.0 g/l NaCN

Pulp Density: 33 % solids

Fineness: -100 mesh

Forest Hill Tailings Sample

Regents Balance

Time Cumul. hrs	ADDED GRAMS ACTUAL NaCN	ADDED GRAMS ACTUAL $Ca(OH)_2$	ADDED GRAMS EQUIVALENT NaCN	ADDED GRAMS EQUIVALENT CaO	RESIDUAL g NaCN	RESIDUAL g CaO	CONSUMED g NaCN	CONSUMED g CaO	PH
Start	1.05	4.00	1.00	2.92					
3					0.85	0.70	0.15	2.22	12.6
	0.158		0.15						
6					0.85	0.60	0.15	0.10	12.55
	0.158		0.15						
12					1.00	0.48		0.12	12.4
24					1.00	0.44		0.04	12.35
36					1.00	0.25		0.19	12.23
48					1.00	0.21		0.04	12.19
Total	1.366	4.00	1.30	2.92	1.00	0.21	0.30	2.71	

Cyanide sol'n: 860 ml
Wash sol'n: 980 ml
Residue: 512.4 g

Reagents Consumption: Kg/t

NaCN: 0.60
CaO: 5.42

CYANIDATION TEST RESULTS

WEIGHT - GR.:

TEST NO.: 120 A, 120 B

DATE:

TEST BY:

OF TEST:

PLICATION	Time Min.	% Solids	pH	Unit			Reagents - lbs/ton												GRIND Size	GRIND Wt.%	REMARKS

PRODUCT	Wt. GR. Amount	Wt. %	ASSAYS g/t or mg/l Au	METAL CONTENT	DISTRIBUTION - % Au	
A. Cyanide Sol'n	860	ml	1.03		81.6	)
Wash	1000	ml	0.12		11.1	)92.7
Residue	499.6	g	0.16		7.3	
Head (calc.)			2.17		100.0	
B. Cyanide Sol'n	860	ml	1.04		82.9	)
Wash	980	ml	0.11		10.0	)92.9
Residue	512.4	g	0.15		7.1	
Head (calc.)			2.11		100.0	

TEST NUMBER 121 A

CYANIDATION TEST RECORD

Object of Test: Determine optimum cyanidation conditions

Sol'n Conc. 1.0 g/l NaCN

Feed: 500 g;

Pulp Density: 33 % solids

Sol'n Vol. 1000 ml

Fineness: -200 mesh

Hours 48

Forest Hill Tailings Sample

Regents Balance

Time Cumul. hrs	ADDED GRAMS ACTUAL NaCN	ADDED GRAMS ACTUAL $Ca(OH)_2$	ADDED GRAMS EQUIVALENT NaCN	ADDED GRAMS EQUIVALENT CaO	RESIDUAL g NaCN	RESIDUAL g CaO	CONSUMED g NaCN	CONSUMED g CaO	PH
Start	1.05	4.00	1.00	2.92					
3					0.90	0.60	0.10	2.32	12.25
	0.105		0.10						
6					1.00	0.56		0.04	12.54
12					1.00	0.54		0.02	12.46
24						0.48		0.06	12.40
36						0.43		0.05	12.37
48						0.35		0.08	12.34
Total	1.155	4.00	1.10	2.92	1.00	0.35	0.10	2.57	

Cyanide sol'n: 725 ml
Wash sol'n: 1020 ml
Residue: 506.0 g

Reagents Consumption: Kg/t

NaCN: 0.20
CaO: 5.14

TEST NUMBER 121 B

CYANIDATION TEST RECORD

Object of Test: Determine optimum cyanidation conditions

Feed: 500 g;

Sol'n Vol. 1000 ml

Hours 48

Sol'n Conc. 1.0 g/l NaCN

Pulp Density: 33 % solids

Fineness: -200 mesh

Forest Hill Tailings Sample

Regents Balance

Time Cumul. hrs	ADDED GRAMS ACTUAL NaCN	ADDED GRAMS ACTUAL $Ca(OH)_2$	ADDED GRAMS EQUIVALENT NaCN	ADDED GRAMS EQUIVALENT CaO	RESIDUAL g NaCN	RESIDUAL g CaO	CONSUMED g NaCN	CONSUMED g CaO	pH
Start	1.05	4.00	1.00	2.92					
3					0.90	0.61	0.10	2.31	12.58
	0.105		0.10						
6					1.00	0.58		0.03	12.52
12					1.00	0.56		0.02	12.48
24					1.00	0.52		0.04	12.44
36					1.00	0.44		0.08	12.40
48					1.00	0.36		0.08	12.36
Total	1.155	4.00	1.10	2.92	1.00	0.36	0.10	2.56	

Cyanide sol'n: 740 ml
Wash sol'n: 1030 ml
Residue: 506.2 g

Reagents Consumption: Kg/t

NaCN: 0.20
CaO: 5.12

CYANIDATION TEST RESULTS

WEIGHT-GR.:

TEST NO.: 121 A, 121 B

T OF TEST:

DATE:

TEST BY:

OPERATION	Time Min.	% Solids	pH	Unit			Reagents - lbs/ton												GRIND Size	GRIND Wt%	REMARKS

PRODUCT	Wt. GR Amount	Wt. %	ASSAYS g/t or mg/l Au								METAL CONTENT								DISTRIBUTION - % Au							
A. Cyanide Sol'n	725	ml	0.9%																72.2	91.5						
Wash	1020	ml	0.18																19.3							
Residue	506.0	g	0.16																8.5							
Head (calc.)			1.88																100.0							
B. Cyanide Sol'n	740	ml	0.97																73.3	91.2						
Wash	1030	ml	0.17																17.9							
Residue	506.2	g	0.17																8.8							
Head (calc.)			1.93																100.0							

TEST NUMBER 122 A

CYANIDATION TEST RECORD

Object of Test: Determine optimum cyanidation conditions

Sol'n Conc 1.0 g/l NaCN

Feed: 500 g;

Pulp Density: 33 % solids

Sol'n Vol. 1000 ml

Fineness: -200 mesh

Hours 24

Forest Hill Tailings Sample

Regents Balance

Time Cumul. hrs	ADDED GRAMS ACTUAL NaCN	ADDED GRAMS ACTUAL $Ca(OH)_2$	ADDED GRAMS EQUIVALENT NaCN	ADDED GRAMS EQUIVALENT CaO	RESIDUAL g NaCN	RESIDUAL g CaO	CONSUMED g NaCN	CONSUMED g CaO	PH
Start	1.05	3.50	1.00	2.56					
3					0.80	0.40	0.20	2.16	11.7
	0.21		0.20						
3									
6					0.95	0.20	0.05	0.20	10.07
	0.05	1.0	0.05	0.73					
12					0.95	0.83	0.05	0.10	11.0
	0.05		0.05						
24					1.0	0.43		0.40	11.0
Total	1.360	4.50	1.30	3.29	1.0	0.43	0.30	2.86	

Cyanide sol'n: 720 ml
Wash sol'n: 995 ml
Residue: 506.4 g

Reagents Consumption: Kg/t

NaCN: 0.60
CaO: 5.72

CYANIDATION TEST RESULTS

WEIGHT - GR.:

TEST NO.: 122 A.

DATE:

OF TEST:

TEST BY:

MATERIAL	Time Min.	% Solids	pH	Unit			Reagents - lbs/ton												GRIND Size	GRIND Wt%	REMARKS

PRODUCT	Wt. GR Amount	Wt. %	ASSAYS g/t or mg/l Au							METAL CONTENT							DISTRIBUTION - % Au							
Cyanide Sol'n	720	ml	0.90														62.9	)						
Wash	995	ml.	0.19														18.4	)81.3						
Residue	506.4	g	0.38														18.7							
Head (calc.)			2.03														100.0							

APPENDIX E

FLOTATION AND CYANIDATION OF THE CONCENTRATE

TEST 125

TEST NUMBER 125

CYANIDATION TEST RECORD

Object of Test: Cyanidation of the flotation concentrate

Feed: 500 g;

Sol'n Vol. 1000 ml

Hours 48

Sol'n Conc. 1.0 g/l NaCN

Pulp Density: 33 % solids

Fineness: 98.5% -80 microns

Forest Hill Tailings Sample

Regents Balance

Time Cumul. hrs	ADDED GRAMS ACTUAL NaCN	ADDED GRAMS ACTUAL $Ca(OH)_2$	ADDED GRAMS EQUIVALENT NaCN	ADDED GRAMS EQUIVALENT CaO	RESIDUAL g NaCN	RESIDUAL g CaO	CONSUMED g NaCN	CONSUMED g CaO	pH
Start	1.05	6.00	1.00	4.38					12.2
2					0.75	0.21	0.25	4.17	12.26
	0.26	0.68	0.25	0.50					
6					0.95	0.25	0.05	0.46	12.25
	0.052	1.00	0.05	0.73					
12					1.00	0.42		0.56	12.40
24					0.90	0.21	0.10	0.21	12.20
	0.105	0.50	0.10	0.36					
36					0.95	0.32	0.05	0.25	12.30
	0.052	0.50	0.05	0.36					
48					0.95	0.40	0.05	0.28	12.43
Total	1.519	8.68	1.45	6.33	0.95	0.40	0.50	5.93	

Cyanide sol'n: 705 ml
1st Wash sol'n: 990 ml
Residue: 501.9 g
2nd Wash sol'n: 875 ml
3rd Wash sol'n: 1000 ml

Reagents Consumption: Kg/t

NaCN: 1.0
CaO: 11.86

FLOTATION AND CYANIDATION TEST RESULTS

WEIGHT - GR.:

TEST NO.: 125

...T OF TEST:

DATE:

TEST BY:

...LLATION	Time Min.	% Solids	pH	Unit			Reagents - lbs/ton											GRIND Size	GRIND Wt%	REMARKS

...PRODUCT	Wt. Gr. Amount	Wt. %	ASSAYS g/t or mg/l							METAL CONTENT							DISTRIBUTION - %							
			Au														Au							
Flotation																								
Flot. Conc.		9.1	21.65														92.7							
Tails		90.9	0.17														7.3							
Head (calc.)		100.0	2.11														100.0							
Cyanidation																								
Cyanide Sol'n	705	ml	11.10														72.0	)						
1st Wash "	990	ml	2.35														21.4	) 96.0						
2nd " "	875	ml	0.24														1.9	)						
3rd " "	1000	ml	0.073														0.7	)						
RESIDUE	501.9	g	0.66														4.0							
Head(Flot.Conc)calc			21.65														96.0							